

# LPMS-CU2

## Quick Start Guide ver. 1.3



LP-RESEARCH Inc.  
<http://www.lp-research.com>

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## I. Introduction

Welcome to the LP-RESEARCH Motion Sensor LPMS-CU2 Quick Start Guide.

In this documentation we will explain everything you need to know to quickly set up the LPMS-CU2 hardware, install its software and get started with sensor data acquisition. We have put a lot of effort into making the LPMS-CU2 a great product, but we are always eager to improve and work on new developments. If you have any further questions or comments regarding this documentation, please feel free to contact us anytime.

For more information on the LPMS-CU2 or other product series, please refer to datasheets and user manuals, available from the LP-RESEARCH website at the following address:  
<http://www.lp-research.com>.



## II. Document Revision History

Date	Revision	Changes
2016-07-11	1.0	- Initial release.
2016-08-31	1.1	- Add the tables of relations between baudrate and data update rate.
2016-10-13	1.2	- Correction on input voltage range
2018-03-27	1.3	- Updated tables of parameters
2018-06-21	1.4	- Updated maximum supply voltage



### III. Device Specification

**Table 1. LPMS-CU2 Main Specification**

Parameters	LPMS-CU2
<b>Output range of Euler angle</b>	Roll: ±180°; pitch: ±90°; Yaw: ±180°
<b>Bandwidth</b>	400Hz
<b>Resolution</b>	<0.01°
<b>Accuracy</b>	<0.5° (Static), <2° RMS (Dynamic)
<b>Max. instant impact (0.1 ms)</b>	10,000 g
<b>Output data type</b>	Raw data/Euler/Quaternion/Linear acceleration/Air pressure/Altitude/Temperature
<b>Internal sampling rate</b>	400Hz
<b>Communication interface</b>	CAN BUS / USB*
<b>Max. baudrate</b>	1M bps
<b>Communication protocol</b>	LPCAN / CANOpen
<b>Size</b>	34.5x34x15.7 mm
<b>Weight</b>	17.6 g
<b>Max. data update rate</b>	400Hz
<b>Power consumption</b>	<165mW@3.3V
<b>Power supply</b>	5V~18V DC (CAN) / 5V (USB)
<b>Working temperature</b>	-40~+80 °C
<b>Connector</b>	DB9(female) / micro-USB type B

\* The USB port is primarily used for the connection with windows-based operation systems. With the use of LpmsControl software, users can easily modify the sensor settings and upgrade the sensor firmware.

**Table 2. Accelerometer Specification**

Parameters	Typical Value	Unit
<b>Measurement range</b>	$\pm 2/\pm 4/\pm 8/\pm 16$	g
<b>Sensitivity</b>	0.061/0.122/0.244/0.488	mg/LSB
<b>Linear acceleration sensitivity change vs. temperature</b>	$\pm 1$	%
<b>Linear acceleration typical zero-g level offset accuracy</b>	$\pm 40$	mg
<b>Linear acceleration zero-rate change vs. temperature</b>	$\pm 0.5$	mg/ $^{\circ}$ C
<b>Acceleration noise density</b>	90 (FS = $\pm 2$ g ODR = 104 Hz)	$\mu$ g/ $\sqrt{Hz}$

**Table 3. Gyroscope Specification**

Parameters	Typical Value	Unit
<b>Measurement range</b>	$\pm 125/\pm 245/\pm 500/\pm 1000/\pm 2000$	dps
<b>Sensitivity</b>	4.375/8.75/17.50/35/70	mdps/LSB
<b>Angular rate sensitivity change vs. temperature</b>	$\pm 1.5$	%
<b>Angular rate typical zero-rate level</b>	$\pm 10$	dps
<b>Angular rate typical zero-rate level change vs. temperature</b>	$\pm 0.05$	dps/ $^{\circ}$ C
<b>Rate noise density</b>	7	mdps/ $\sqrt{Hz}$

**Table 4. Magnetometer Specification**

Parameters	Typical Value		Unit
<b>Measurement range</b>	$\pm 4/\pm 8/\pm 12/\pm 16$		Gauss
<b>Sensitivity</b>	6842/3421/2281/1711		LSB/gauss
<b>Zero-gauss level</b>	$\pm 1$ (FS= $\pm 4$ gauss)		gauss
<b>RMS noise</b> <b>(Ultra-high-performance mode)</b>	X axis	3.2	mgauss
	Y axis	3.2	mgauss
	Z axis	4.1	mgauss
<b>Non-linearity</b>	$\pm 0.12$		%FS

**Table 5. Pressure and Humidity Sensor Specification**

Parameters	Typical Value	Unit
<b>Pressure measurement range</b>	300~1100	hPa
<b>Temperature coefficient of offset</b>	$\pm 1.5$	Pa/K
<b>Absolute accuracy pressure</b>	$\pm 1.0$	hPa
<b>Pressure sensitivity</b>	0.18	Pa
<b>Pressure noise</b>	1.3	Pa
<b>Humidity measurement range</b>	0~100	%RH
<b>Humidity accuracy</b>	$\pm 3$	%RH
<b>Humidity latency (10~90~10 %RH, 25 °C)</b>	$\pm 1$	%RH
<b>Humidity sensitivity</b>	0.008	%RH
<b>Humidity noise</b>	0.02	%RH
<b>Humidity stability (10~90 %RH, 25 °C)</b>	0.5	%RH/year

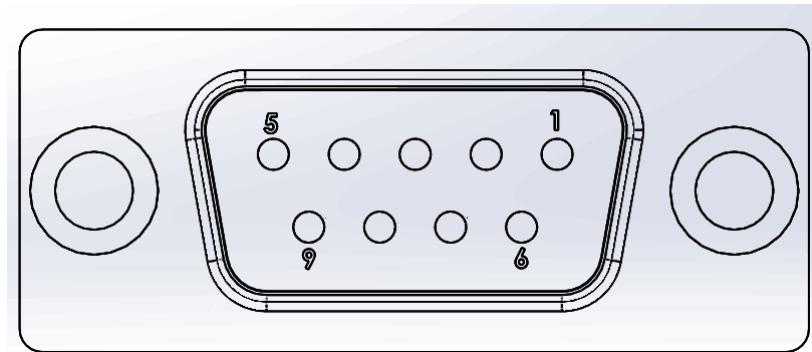
**Table 6. Relation between CAN Bus Baudrate and Max. Update Rate**

Baudrate (kbps)	Max. Update Rate (Hz)
125	200
250	400
500	400
1000	400

**Table 7. Relation between LPBUS Baudrate and Max. Update Rate**

Baudrate (kbps)	Max. Update Rate (Hz)
125	100
250	200
500	400
1000	400

## IV.CAN BUS Connector Pinout



Pin no.	Signal	Remark
1	VDD	+5V~+18VDC
2	CAN-	
3	RES	Reserved (must be floating)
4	RES	Reserved (must be floating)
5	GND	
6	GND	
7	CAN+	
8	RES	Reserved (must be floating)
9	RES	Reserved (must be floating)



## V.Operation

### OpenMAT Software Installation

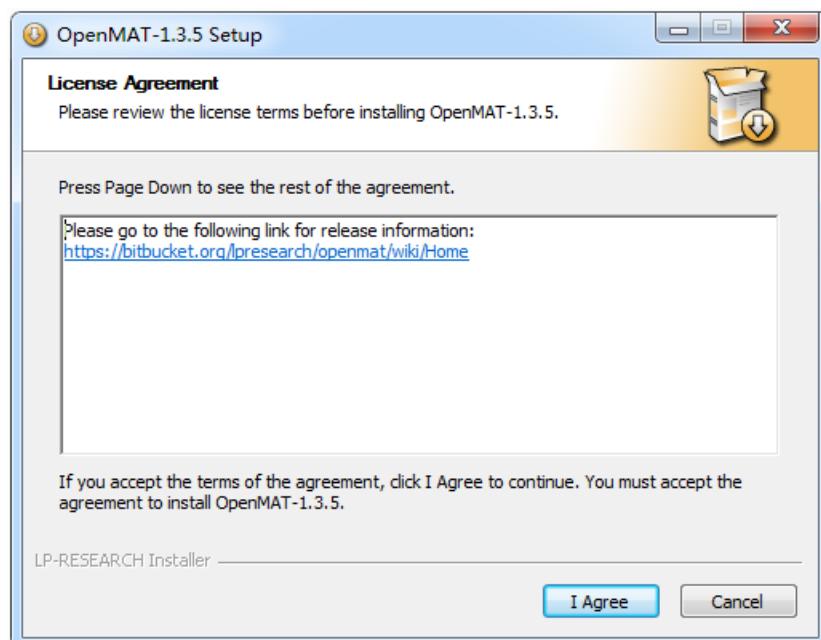
We offer windows OS based software called LpmsControl for users to easily manipulate the LPMS-CU2 sensor. The LpmsControl software is a sub program of OpenMAT software. Please choose a correct version of OpenMAT software from our homepage based on the operation system specification. The followings show an example of installing the OpenMAT software under Windows 7 32bit system.

- 1) Go to: <http://www.lp-research.com/support/>, and download the latest version of OpenMAT for the sensor, like OpenMAT Version 1.3.5 (Windows 32-bit binary) showed as below.

The screenshot shows the 'Downloads' section of the LPMS-CU2 website. It includes links for the 'LPMS User's Guide' (version 1.3.4) and a section for 'OPENMAT BINARIES' (version 1.3.5). The 'OPENMAT BINARIES' section lists several files, with 'OpenMAT Version 1.3.5 (Windows 32-bit binary)' highlighted by a red box.

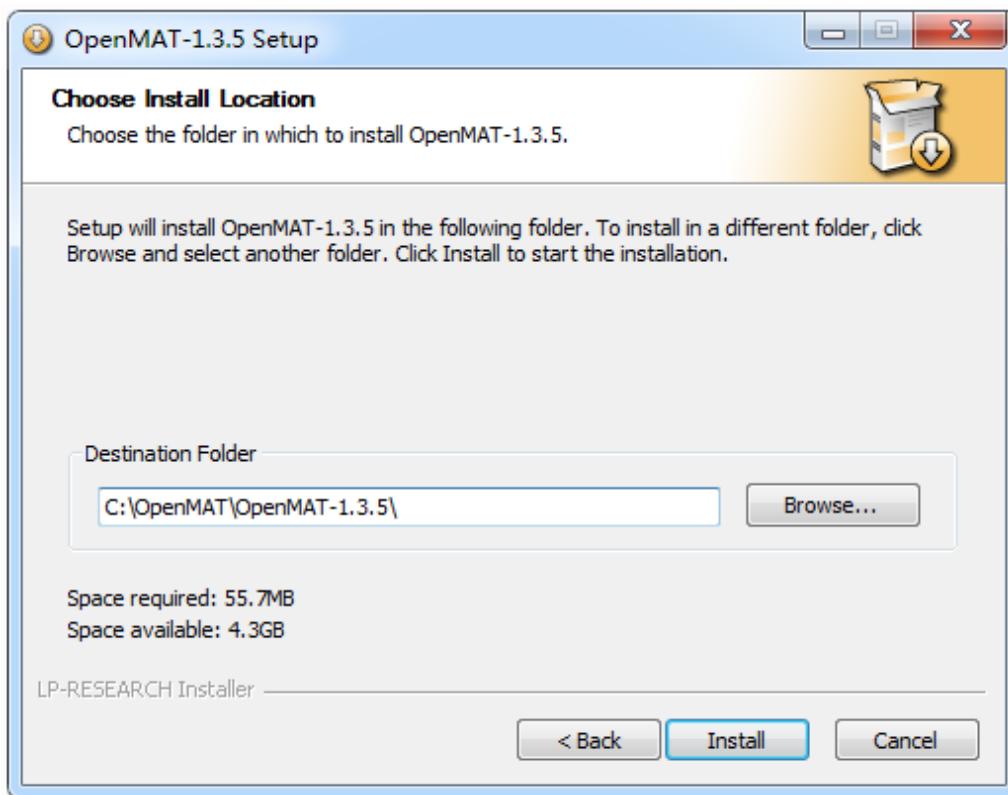
Version	Description
OpenMAT Version 1.3.5	(Windows 32-bit binary)
LpSensor-1.3.5 library	(Ubuntu Linux 32-bit binary)
LpSensor-1.3.5 library	(Ubuntu Linux 64-bit binary)
LpSensor-1.3.5 library	(Ubuntu Linux armv7hf binary, suits raspberry pi)
LpSensor-1.3.5 library	(Ubuntu Linux armv7hf binary, suits Jetson TX1)

- 2) Run the installer after the download process is finished, and push the "I Agree" button for the next step.

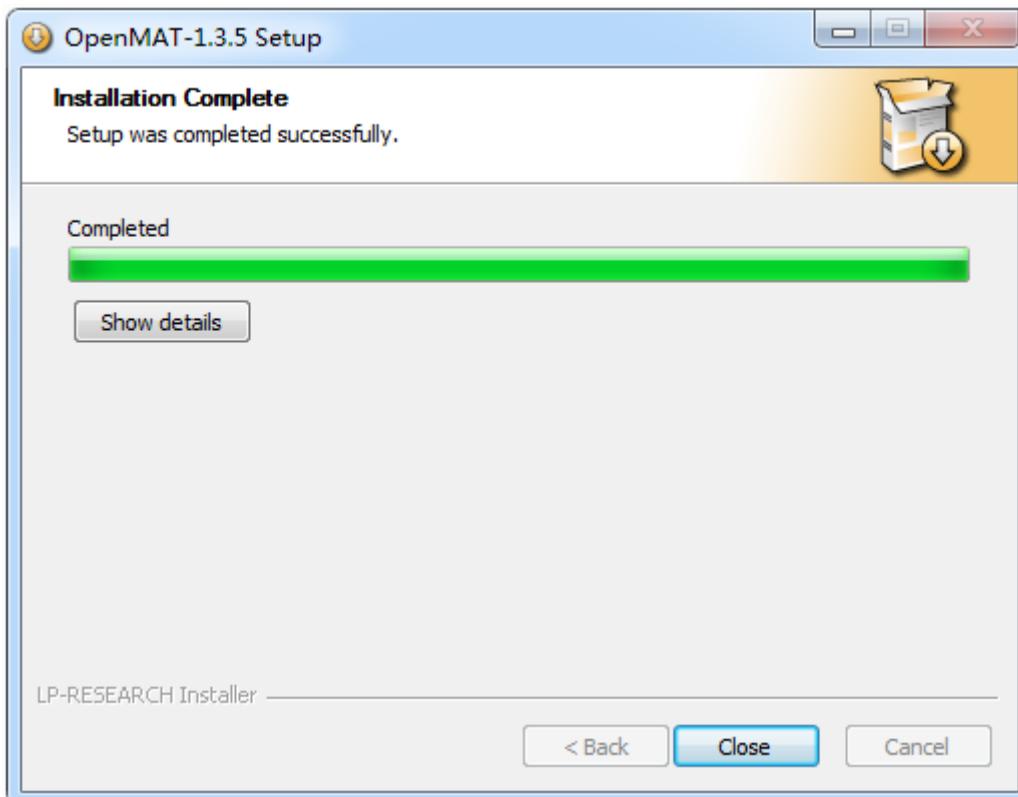




- 3) Push the "Browse" button to select the installation path of the program, and then push "Install" to start the installation process.



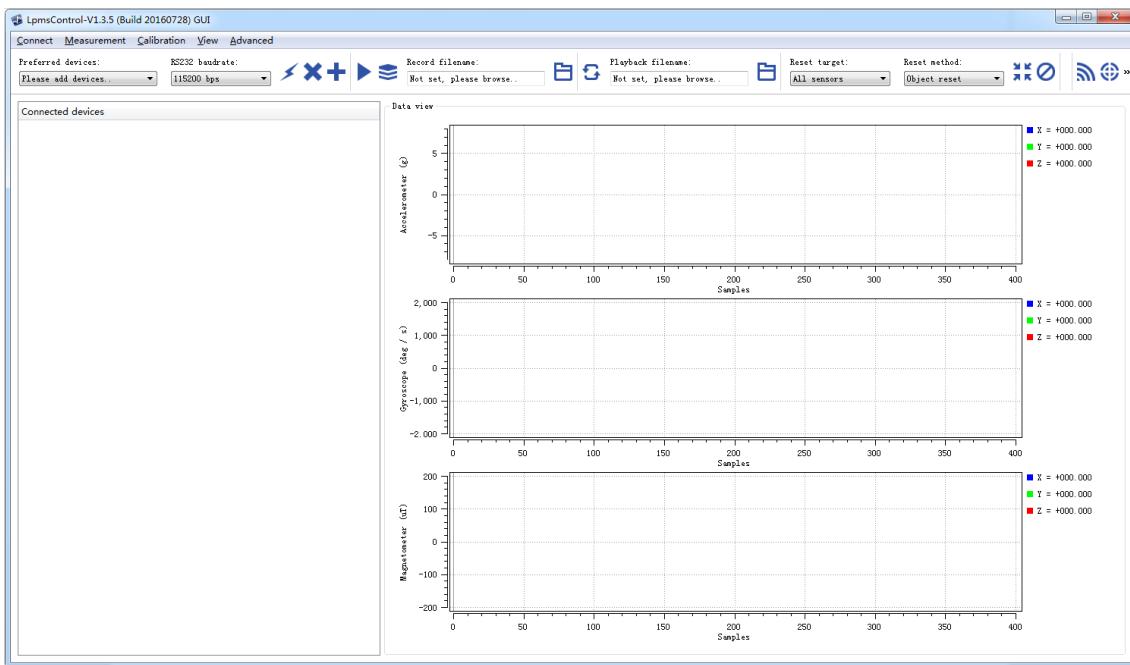
- 4) Push the "Close" button to complete the installation.





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To run the LpmsControl software from the start menu of your windows system, you can see the following interface.





## Connection with PC

LPMS-CU2 can communicate with a host system via either CAN BUS or USB interface.

**Notice: Both interfaces cannot be used at the same time.**

The USB port is aimed at connecting with a windows OS based host system for the sensor. User can change the sensor settings and acquire sensor data by using our LpmsControl software. The CAN BUS port is aimed at connecting with various types of industrial host systems via the CAN+ and CAN- Bus. Users can change the sensor settings and acquire sensor data based on our CAN communication protocols. The sensor operation via either CAN BUS or USB interface at a windows operation system is introduced in the following sections.

### 1. Via CAN BUS interface

In order to connect the sensor to a PC via the CAN BUS port, a CAN-to-USB converter is needed. LpmsControl software is supporting the PCAN-USB cable from PEAK-System Technik GmbH. The detailed information of PCAN-USB can be referred to: <http://www.peak-system.com>.

After connecting the PCAN-USB cable to a PC, the system will pop out a notice of driver installation. Please download and install the corresponding driver of PCAN-USB from the webpage of PEAK-System. The device manager of windows operation system will show the PCAN-USB device if the driver is installed correctly, as showed in the following image.

Before connecting LPMS-CU2 with PCAN-USB cable, the hardware setting of the DB9 port on PCAN-USB needs to be modified. In default, the pin no.1 of this DB9 port is not outputting 5V voltage. Please refer to section "Voltage Supply of External Devices" in the manual of PCAN-USB to have the pin no.1 output +5V.



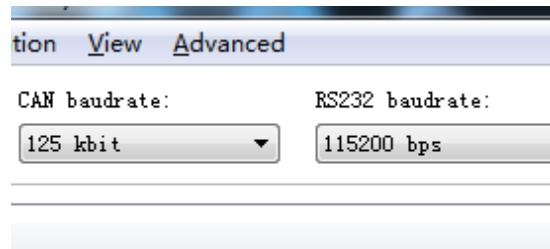
When the hardware setting of PCAN-USB is completed, users can connect it with LPMS-CU2 sensor. Then by plugging the PCAN-USB to PC, the LED on the sensor should behave like a pulsating light at blue color, which indicates the sensor is functionally working.

Please follow the instructions below to complete the remaining steps.

- 1) To start the LpmsControl software. If the PCAN-USB cable has been connected with PC,



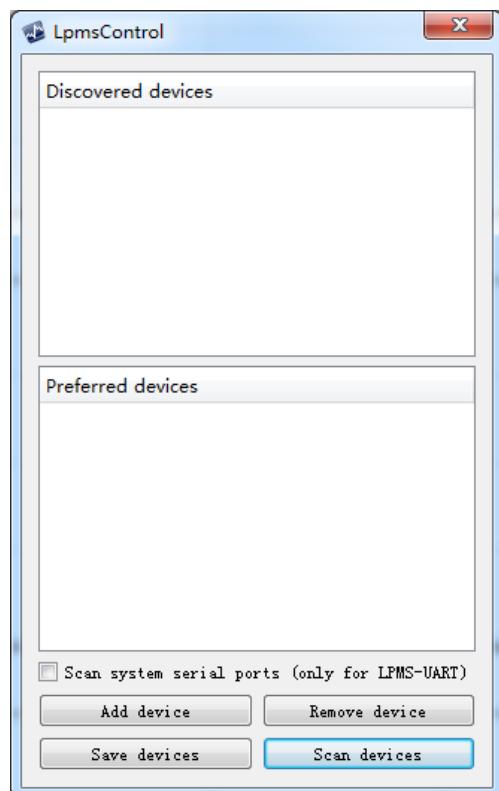
the CAN baudrate setting item should be showed up on the toolbar, seen as the following image. Please choose the correct baudrate according to your sensor setting. The default value is 125kbps.



- 2) To select the "Add/remove sensor" under "Connect" menu or click the "+" button on toolbar.



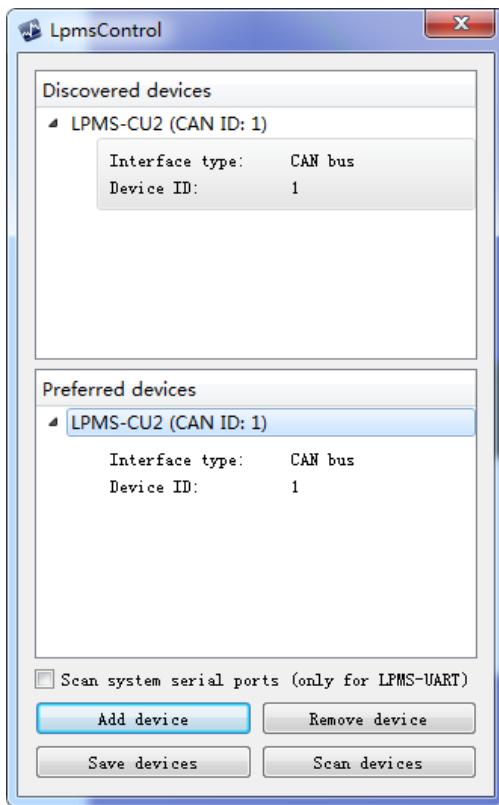
The "add device" window will pop out, as following.



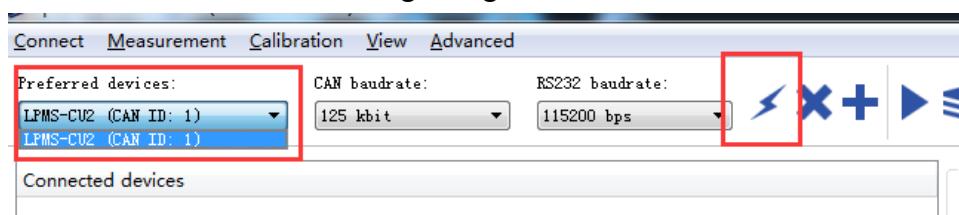
- 3) To click the "Scan devices" button and start the device discovery process. Please wait until the process is done.
- 4) To select the target sensor ID from the "Discovered devices" list, for example, "LPMS-CU2



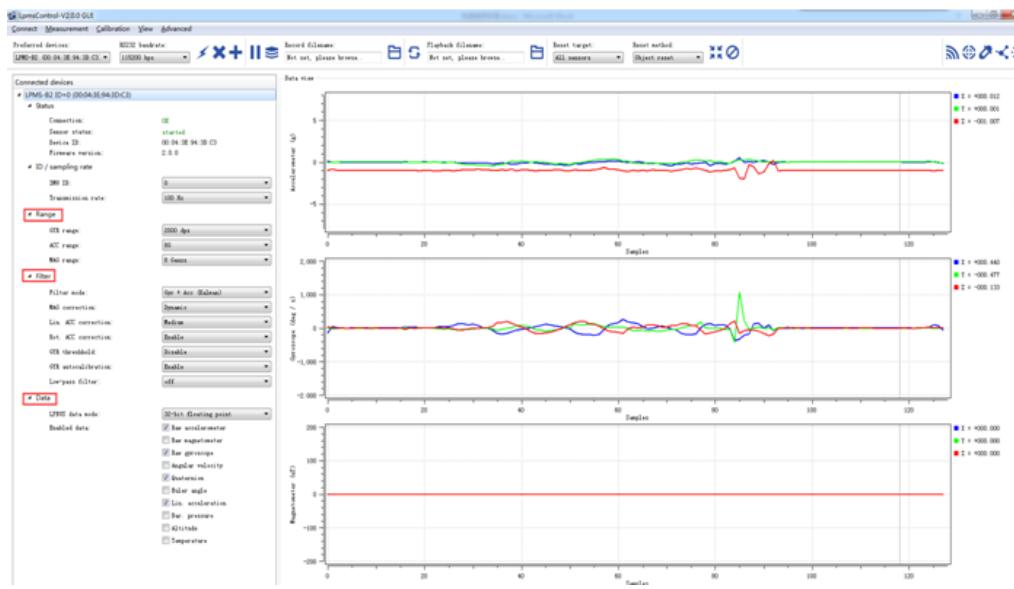
(CAN ID: 1)" in the following image.



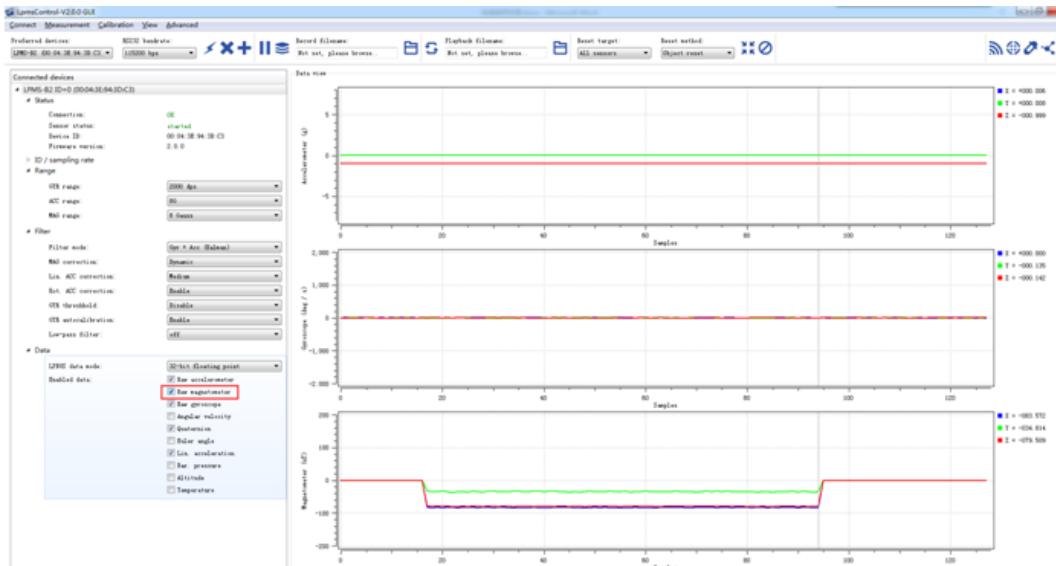
- 5) To add the selected sensor to "Preferred devices" list by clicking the "Add device" button.
- 6) To click the "Save devices" button to save the preferred devices list, and return to main interface of LpmsControl.
- 7) To select the target sensor ID from the Preferred devices list, and click Connect function under "Connect" menu or click the lightning button on toolbar to connect the sensor.



After completing all the steps above, the LPMS-CU2 should have been connecting with windows system. Users can check all the data visualization and parameter settings of the sensor from LpmsControl.



On the left side of the main interface of LpmsControl, users can change the sensor settings, like measurement range, filter modes, data updating rate, etc. Moreover, the types of output data can be modified by checking or unchecking the check box of each parameter. For example, in the following image the "raw magnetometer" is checked so that the acquisition of magnetic data is enabled.



## 2. Via USB interface

Users can connect LPMS-CU2 to a PC via USB port. After plugging in, windows operation system will activate the installation of USB drivers automatically. USBXpress device will be showed up in the device manager if the driver has been installed successfully, seen as



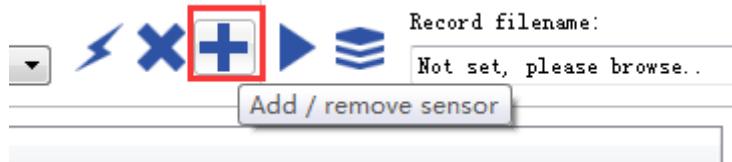
following.



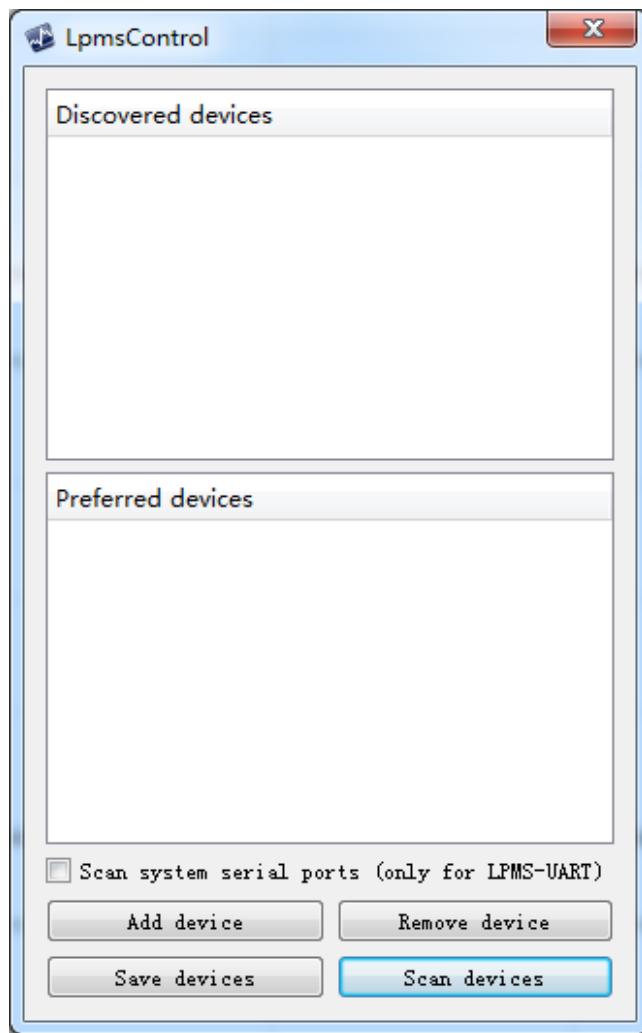
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Please follow the instructions below to complete the remaining steps.

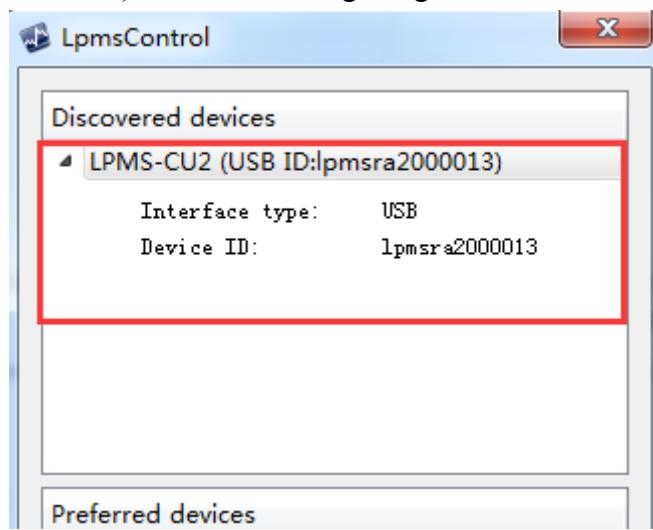
- 1) To select the "Add/remove sensor" under "Connect" menu or click the "+" button on toolbar of LpmsControl.



The "add device" window will pop out, as following.

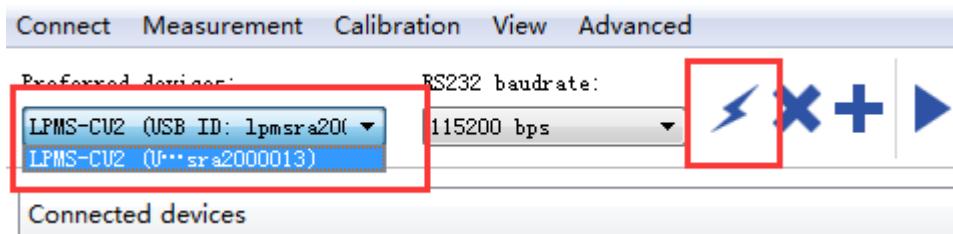


- 2) To click the "Scan devices" button and start the device discovery process. Please wait until the process is done.
- 3) To select the target sensor ID from the "Discovered devices" list, for example, "LPMS-CU2 (USB ID: lpmsra2000013 )" in the following image.

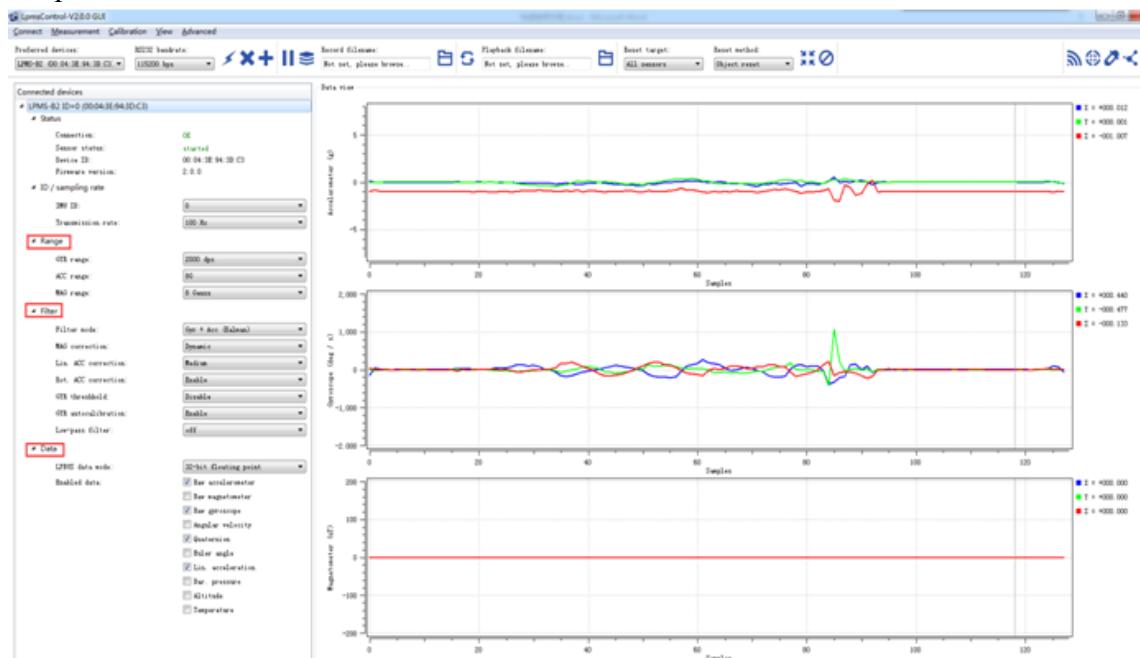


- 4) To add the selected sensor to "Preferred devices" list by clicking the "Add device" button.

- 5) To click the "Save devices" button to save the preferred devices list, and return to main interface of LpmsControl.
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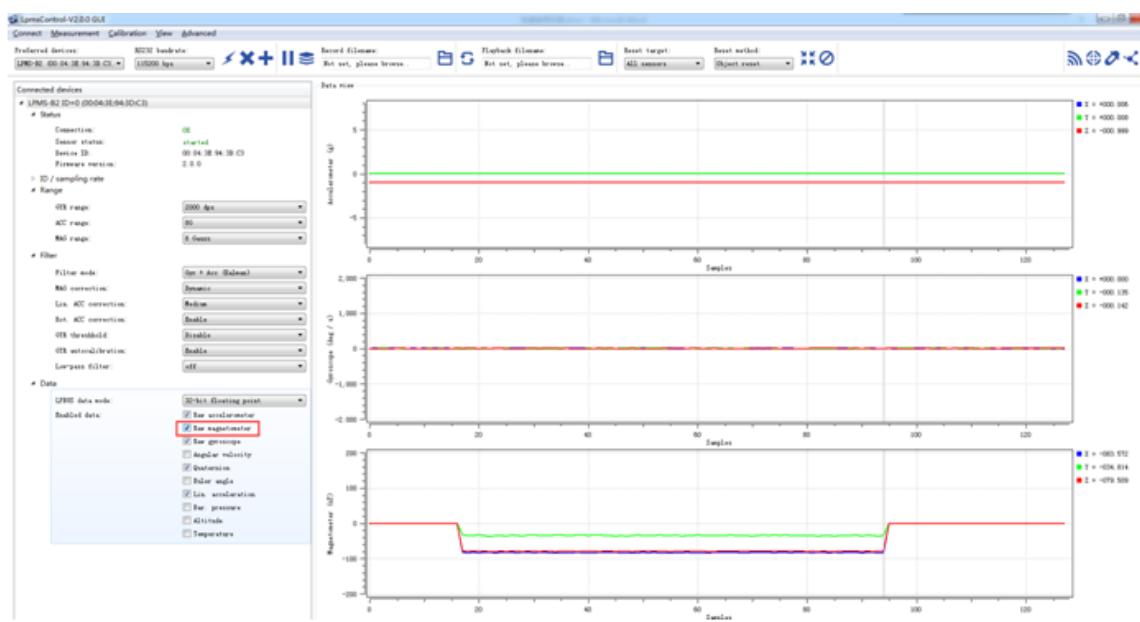
After completing all the steps above, the LPMS-CU2 should have been connecting with windows system. Users can check all the data visualization and parameter settings of the sensor from LpmsControl.



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